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(54) Method and apparatus for treating broke

(57) The present invention relates to a method of and apparatus for treating broke. Especially the invention relates to treating the so-called dry broke from the paper and/or paperboard machine so that the pulp may be metered back to said machine.

The method and apparatus for treating the so-called dry broke according to the invention, by which method and apparatus the so-called dry broke material obtained from a paper, paperboard or the like production machine is defiberized with a defiberizer (10) and thickened with a thickening device for storing at high consistency, are characterized in that directly after said defiberizing the broke is thickened into high consistency and taken into a storing container at a consistency of 12 - 45 %.

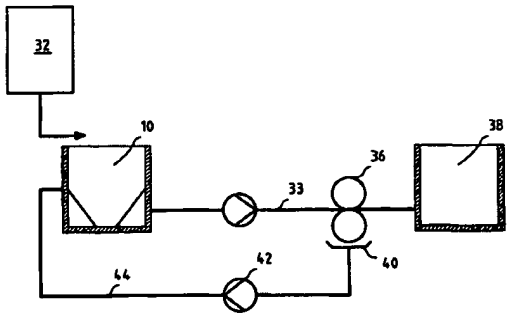

Fig. 2

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Description

[0001] The present invention relates to a method of and apparatus for treating broke. Especially the invention relates to treating broke coming from a paper and/or paperboard machine so that the pulp may be metered back to said machine in a way which is more preferable than prior art methods in view of both paper and/or paperboard manufacture and environmental aspects.

[0002] The word broke refers to waste material generated by a paper, paperboard or the like machine in some stage of the production process. Broke is generated continuously in the so-called edge cutting where the paper or paperboard web produced by the paper or paperboard machine is cut to the desired width, i.e. at both sides of the web a strip of essentially finished product is cut off. In addition to that, broke is generated during process breaks caused by various reasons, whereby the whole production of the production machine has to be diverted to the broke system. Broke is also generated by the winder, and sometimes even whole paper or paperboard rolls are damaged when still in the mill so that they have to be returned to reuse through the broke system. In other words, the water content of broke varies to a remarkable extent according to the generation point of the broke. In the beginning stage of the process, e.g. on the wire part of the paper machine, the broke may well be said to have a consistency, whereby the broke is often referred to as so-called wet broke, but broke obtained after the press section is already in most cases referred to as so-called dry broke. And especially when whole paper rolls are diverted to broke, the product practically corresponds to dry finished product.

[0003] In a conventional broke system, the broke is stored in a consistency of about 3 - 4 %. Such a low consistency requires huge buffer tanks for the paper or paperboard machine for the process waters, because breaks in the production process and sometimes long discontinuous process stages must be prepared for beforehand. In such a case, the broke system has to be able to receive all paper or paperboard produced by the machine either as such, whereby the broke is wet broke being collected in the couch pit or, in case of dry broke, through broke pulpers or the like utilizing process waters in the slushing. Said big buffer tanks increase the time needed for changes of grade and complicate the regulation of the process. In this connection it is worth mentioning that the dimensions of said broke and water containers of big production machines are typically in the order of thousands of cubic meters. As an example it may be stated that when the production of a paper machine is e.g. 700 t/d, the size of both the dilution water tank and the broke tank is about 5000 m^3.

[0004] In addition to space requirements and big investments, these large containers cause problems due to relatively slow water circulations creating advantageous conditions for the forming of various slime and microbe growths. And further, due to large amount of process water needed, the only possibility is actually the use of white water generated in the mill in a sufficient amount. Otherwise it would be necessary to use fresh water from watercourses, the use of which is out of order nowadays. Nevertheless, said white water is a good culture medium for said slime and microbe growths. One more problem worth mentioning is that prior art broke systems have not been capable of removing from the pulp the undesired materials introduced to the pulp with the broke, said undesired materials being various microbes, resins, colloidal materials, starches, paper binding agents and other materials disturbing practically the whole process or at least the functioning of a part of it, but these have gone into the production process with the result of decreased quality of the finished product.

[0005] Figure 1 illustrates a prior art broke system for treating dry broke and comprising a broke pulper, a dilution liquid tank, an intermediate tank, a press, a storage container and pumps required by the process. This prior art broke system operates so that dry broke is introduced into one of several pulpers in the paper machine and diluted during the slushing to an appropriate consistency with white water obtained from the dilution liquid tank. The slushed broke is taken by means of a pump into the intermediate tank in form of a dilute, most usually 2 - 4 %, suspension. From the intermediate tank the dilute broke suspension is lead by means of a pump into the press, with which press the consistency of the broke is raised into storage consistency, usually in the order of 10 - 20 %. The press precipitate is typically removed from the process.

[0006] This kind of prior art broke system treating dry broke typically operates so that the intermediate tank is dimensioned to receive all possible low consistency broke that can be thought to be generated from the paper machine, in other words the whole production of the paper mill during some predetermined period of time. Thus, it is clear that also the dilution liquid tank has to be dimensioned to store all the liquid required for diluting the maximum amount of broke being generated. A further characterizing feature of this prior art process is that the press is dimensioned for treating broke practically on a continuous basis. One of the dimensioning principles is that the press must be capable of treating about 15 - 20 % of the maximum production of the paper machine. That is, the pulpers are dimensioned to defiberize the dry broke quickly to a dilute consistency to be taken into the intermediate tank performing the function of a buffer tank for the continuously operating press.

[0007] To solve said problems, among others, a new type of method and apparatus for treating dry broke has been developed. The method and apparatus for treating pulp broke according to one preferred embodiment of the invention are characterized, e.g., in that the

dry broke is thickened immediately after defiberizing, most commonly slushing performed with a pulper, by means of an applicable thickening device, preferably a press, to a suitable consistency which may be preferably 20 - 35 %, more preferably 25 - 30 % (when thinking more widely, the consistency may vary even in the range of 12 - 45 %, considering all different situations and pulp grades) and stored in said consistency. The broke is stored e.g. in a HC-silo provided with a diluting scraper at the bottom. As an example it may be mentioned that with a paper machine production of 700 t/d, a press capable of producing 700 t/d only and a storage container of about 500 m^3 only are required.

[0008] To put it differently, when a prior art broke treating system requires two storage containers of about 5000 cubic meters (one for low consistency broke and the other for the white water used as dilution liquid), one relatively small press and one HC-storage tower, the system according to our invention requires one thickening device of relatively big size, preferably a press, one HC-storage tower and a small dilution liquid tank, the size of which is about one quarter of the older one.

[0009] The method and apparatus for treating dry broke according to another preferred embodiment of the invention are further characterized in that the filtrate removed from the defiberized pulp by means of a thickening device, preferably a press, is guided back during production break to be used as dilution water in the dry broke defiberizer.

[0010] The method and apparatus according to a third preferred embodiment of the invention are characterized in that in a normal running situation the filtrate of the thickening device, preferably a press, is lead to a suitable separation device in order to remove undesired materials and impurities and further taken into the white water treatment system.

[0011] Other characterizing features of the method and apparatus according to the invention are disclosed in the appended patent claims.

[0012] As advantages of the method and apparatus according to the invention, the following may be mentioned, among others:

- by storing the pulp in high consistency only and thus leaving out containers causing long delays, the water circulations are intensified, thus preventing the generation of conditions favorable for slime and microbe growths,
- the size of the circulation water containers is essentially decreased, as water absorbed in the broke during the defiberizing of dry broke is immediately removed from the broke and returned into the defiberizer for diluting the broke,
- storing the defiberized broke at a high consistency decreases the size of the broke tank to a fractional part of dimensions needed nowadays (including both the low-consistency intermediate tank and the HC -storage container),
- by treating the filtrate leaving the press by means of an appropriate separating technique, the undesired materials coming with the broke may be removed from the process,
- because the water amount required for the process is essentially decreased, water being stored for dilution may be e.g. clear filtrate from a disc filter instead of white water only, which is preferable for preventing slime and microbe growths.

[0013] In the following, the method and apparatus according to the invention are explained in more detail with reference to the appended figures, of which

Fig. 1 illustrates a prior art broke system for treating dry broke,
Fig. 2 illustrates a broke system for treating dry broke according to a preferred embodiment of the invention, and
Fig. 3 illustrates a broke system for treating dry broke according to another preferred embodiment of the invention.

[0014] The broke system of Fig. 1 for treating dry broke comprises a broke pulper 10, a dilution liquid tank 12, an intermediate tank 14, a press 16, a storage container 18 and pumps 20 and 22 required by the process. This broke system according to prior art operates so that dry broke is introduced to one of several pulpers 10 of the paper machine, and diluted during the slushing into a suitable consistency with white water obtained from the dilution liquid tank 12. The broke slushed in the pulper 10 is taken by means of pump 20 to the intermediate tank 14 in form of a dilute suspension, most usually 2 - 4 %. From the intermediate tank the dilute broke suspension is taken by means of pump 22 to press 16, by means of which the consistency of the broke is raised to storage consistency, usually in the order of 10 - 20 %. The precipitate of the press is typically removed from the process.

[0015] The broke system for treating dry broke according to Fig. 1 typically operates so that the intermediate tank 14 is dimensioned to receive all possible low-consistency broke that may be considered to originate from the paper machine. Thus it is clear that also the dilution liquid tank 12 has to be dimensioned to receive the whole amount of liquid needed to dilute the dry broke in this kind of situation when broke is originated in maximum amount. The process is further characterized in that the press 16 is dimensioned to treat the broke practically on a continuous basis. One principle of dimensioning is that the press must be capable of treating about 15 - 20 % of the maximum production of the paper machine. In other words, the pulpers 10 are dimensioned to disintegrate the dry broke quickly to a dilute consistency to be taken into the intermediate tank functioning as a buffer tank for the continuously operat-

ing press.

[0016] Fig. 2 is a schematic illustration of a broke system for treating dry broke according to a preferred embodiment of the invention, in which the broke obtained in a dilute consistency from the defiberizer 10, preferably a pulper/pulpers, is lead directly to a thickening device 36, preferably a press, by means of which the consistency of the broke is raised to HC -zone, considering all different situations of use and all grades of pulp to a consistency of 12 - 45 %, preferably to a consistency of 20 - 35 %, more preferably to a consistency of 25 - 30 %, and from which the filtrate is immediately returned back to function as dilution liquid of the defiberizer 10. In accordance with the invention the described system is applicable to the treatment of continuously originating broke such as e.g. trimmings and the maximum amount of broke originating during breaks. According to an alternative embodiment of the invention, the filtrate recirculation illustrated in Fig. 2 is utilized only during web breaks, whereby both the defiberizer and the thickening device must be capable of treating the maximum amount of broke. In that case, there is also the biggest need for dilution liquid, so that by recirculating the dilution liquid it is possible to avoid using big dilution liquid buffer tanks. Only at the initial stage of the defiberizing, dilution liquid obtained from another source 32 is needed. Immediately as the thickening, preferably pressing, following the defiberizing starts functioning, essentially all dilution liquid needed in the defiberizing of the dry broke is obtained from the thickening device, preferably a press 36, the filtrate of which is collected, schematically illustrated into a reservoir 40, and taken by means of a pump 42 via pipe line 44 to the defiberizer 10, preferably a pulper.

[0017] Fig. 3 illustrates a broke system for treating dry broke according to another preferred embodiment of the invention, which system describes the liquid circulation of the process better than the system of Fig. 2. In the process according to Fig. 3, operating like the process of Fig. 2 in view of the defiberizing and thickening of the broke, white water obtained from tank 52 is presented to be used not only for diluting the thickened and defiberized broke fed from the press 36 by means of a feeding apparatus into the HC-container 38 and stored in HC-consistency, but also for diluting the broke during the defiberizing. However, this has been arranged so that the white water from tank 52 is circulated through a fiber-recovery filter 54, preferably a disc filter, where an essential part of solid matter may be removed from the water so that clear filtrate from reservoir 56 is used for diluting the dry broke. The same is planned to be done also when filtrate is removed from the press 36. Filtrate line 48 coming from the press 36 is provided with a separation device 50 for removing undesired material from the filtrate, after which the cleaned filtrate is guided into reservoir 58 for the turbid filtrate of the fiber-recovery filter 54, which turbid filtrate is returned back to the feed of filter 54. And again, from the filter, the clear filtrate obtained from reservoir 56 is guided into its own reservoir 32, which reservoir provides the defiberizer 10 with dilution liquid. In principle, the process of Fig. 3 allows for the following two running possibilities. Firstly, it is possible to treat the filtrate of the thickening device 36 with the separation means for the undesired material 50 and the white water filter 54 in every running situation of the defiberizer 10 and the thickening device 36, although, in consideration of possible breaks, the system should be prepared to treat large amounts of liquid quickly with the separation means 50 and the white water filter 54. In principle, this kind of use is not impossible, though, and, accordingly, is not to be excluded from the scope of protection of the invention. The second running possibility is to circulate the filtrate of the thickening device through the separation means 50 and the white water filter 54 only when the defiberizer 10 and the thickening device are subjected to a constant load i.e. to evenly running constant-flow broke, as, e.g., in the defiberizing of the trimmings. In such a case, the dimensioning of both the separation means 50 and the white water filter 54 is simple, thanks to constant loads. In other words, during peak loads the filtrate of the thickening device may be guided directly through pipeline 44 to the defiberizer 10 without treating with the separation device and the white water filter. Peak loads, during which the filtrate of the thickening device 36 is needed to be guided directly to the defiberizer 10, occur, in addition to web breaks, e.g. in situations when the broke entering the defiberizer is relatively dry, i.e. broke coming from the final stage of paper or paperboard manufacture where the most part of liquid has been removed from the product.

[0018] A further possible method is an arrangement wherein there is a separate separation device for undesired material for treating the filtrate of the thickening device and a treatment apparatus for the filtrate for big loads, i.e. for web breaks or for treating dry broke, so that it would be possible to always clean all the filtrate obtained from the thickening device prior to returning it back to the pulper. In view of process purity this kind of arrangement is naturally the most optimal, but naturally it requires investments, compared to the arrangements of Fig. 2 and 3 in which the existing apparatus of the mill is being utilized whenever possible.

[0019] As already stated in a number of contexts in the description above, in the method according to the invention it is preferable to use a press as the thickening device, because many modem presses are capable of producing a consistency of the desired 25 - 35 %, and when using appropriate pulp grades and/or applicable presses even a consistency of 45 %, although said consistency range is by no means inevitable. As the press, e.g. a drum press described for instance in FI patents 84397 and 88435 may be utilized.

[0020] As noticed from the above, a new kind of method and apparatus for treating broke has been developed. The method and apparatus according to the

invention eliminates many disadvantages of prior art apparatus and methods, thus simplifying the process and its runnability and allowing for more economical paper production and better quality of paper. Nevertheless, one has to notice that only a few preferred embodiments of the invention have been described above without any intention to limit the appended patent claims to said examples only. Thus, it is clear, e.g., that a press is not the only possible thickening device, but other kinds of thickening devices, such as screws or wire presses may be considered to be utilized as well either alone or connected to series. Accordingly, as a defiberizer of the dry pulp, other apparatus may be utilized just as well as the conventional pulpers. The only precondition for the defiberizer is that it must be capable of defiberizing the dry broke to a form that may be returned back to the process.

Claims

1. A method of treating broke, according to which method broke material obtained from a paper, paperboard or the like production machine is diluted, defiberized and thickened for storing at a high consistency, characterized in that after said dilution and defiberizing the broke is taken directly to a thickening device by means of which it is thickened to a high consistency and from which it is taken into the storage container (38) at a consistency of 12 - 45 %.

2. A method according to claim 1, characterized in that the filtrate obtained from said thickening is returned back to said defiberizing to be used as dilution liquid.

3. A method according to claim 1, characterized in that said thickening is practiced with a press (36).

4. A method according to claim 1, characterized in that the filtrate obtained from said thickening is treated in order to remove undesired material from said filtrate.

5. A method according to claim 1, characterized in that the filtrate obtained from said thickening is treated by means of a fiber-recovery device (54).

6. A method according to claim 5, characterized in that at least part of the dilution liquid in the defiberizing is clear filtrate of the fiber-recovery device (54).

7. A method according to claim 1, characterized in that the filtrate obtained from said thickening is returned directly back to said defiberizing to be used as dilution liquid e.g. when there is maximum amount of broke to be treated or the water amount required for diluting the broke is big.

8. A method according to claim 1, characterized in that the filtrate obtained from said thickening is treated in order to remove undesired material from the filtrate when the defiberizing and the thickening are practiced at constant loading.

9. A method according to claim 1, characterized in that the clear filtrate of the fiber-recovery filter (54) is used as liquid being stored for the dilution in the defiberizing.

10. An apparatus for treating broke comprising one or several broke defiberizer/s (10) which may be a pulper or the like, a broke thickening device and a broke storage container, characterized in that said defiberizer (10) is connected via a flow path (33) directly, without an intermediate tank, with the thickening device (36).

11. An apparatus according to claim 10, characterized in that said thickening device (36) is a press.

12. An apparatus according to claim 10, characterized in that said thickening device (36) is provided with means (40) for receiving the filtrate and that said means (40) for receiving the filtrate are connected via a flow path (44) with said defiberizer (10).

13. An apparatus according to claim 12, characterized in that said means (40) for receiving the filtrate are connected via a flow path (48) with the means (50) for removing the undesired material from the filtrate.

14. An apparatus according to claim 12, characterized in that said means (40) for receiving the filtrate are connected to the fiber-recovery device (54).

15. An apparatus according to claim 12, characterized in that said means (40) for receiving the filtrate are connected to the treatment system (58) for treating the turbid filtrate of the fiber-recovery device (54).

16. An apparatus according to claim 10, characterized in that the treatment and recirculation system for the filtrate of the thickening device (36) comprises a fiber-recovery device (54) and a clear filtrate storage container (32) as well as the required number of pumps.

17. An apparatus according to claim 10, characterized in that the treatment and recirculation system for the filtrate of the thickening device (36) further comprises an undesired material separating means (50) prior to the fiber-recovery device (54).

18. An apparatus according to claim 10, characterized

in that said thickening device (36) is provided with means (40) for taking the thickened broke into the HC - storage container (38).

19. An apparatus according to claim 10, characterized in that said thickening device (36) is dimensioned to treat the whole output of the production machine if necessary.

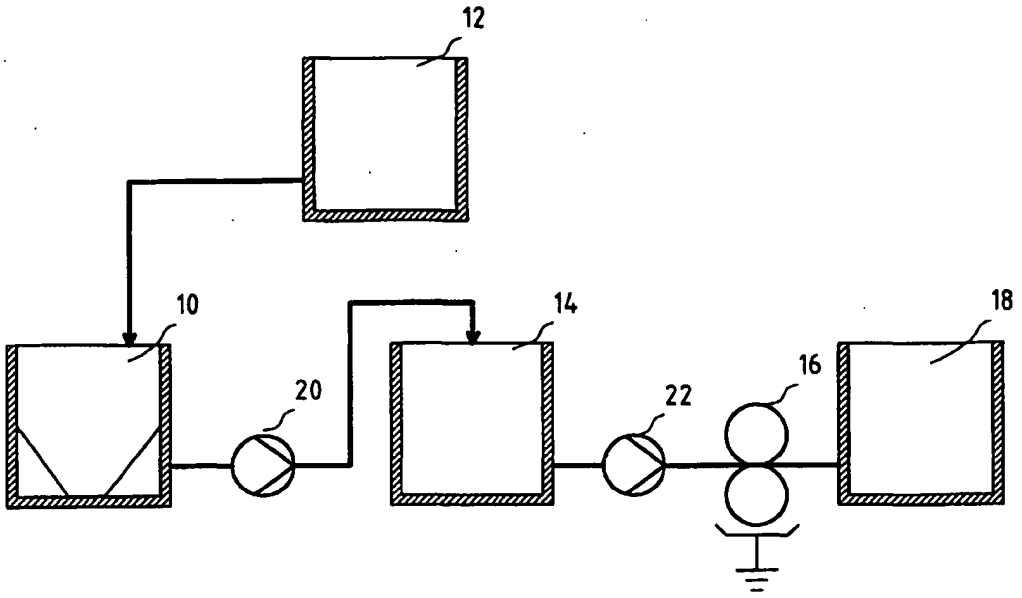

Fig. 1

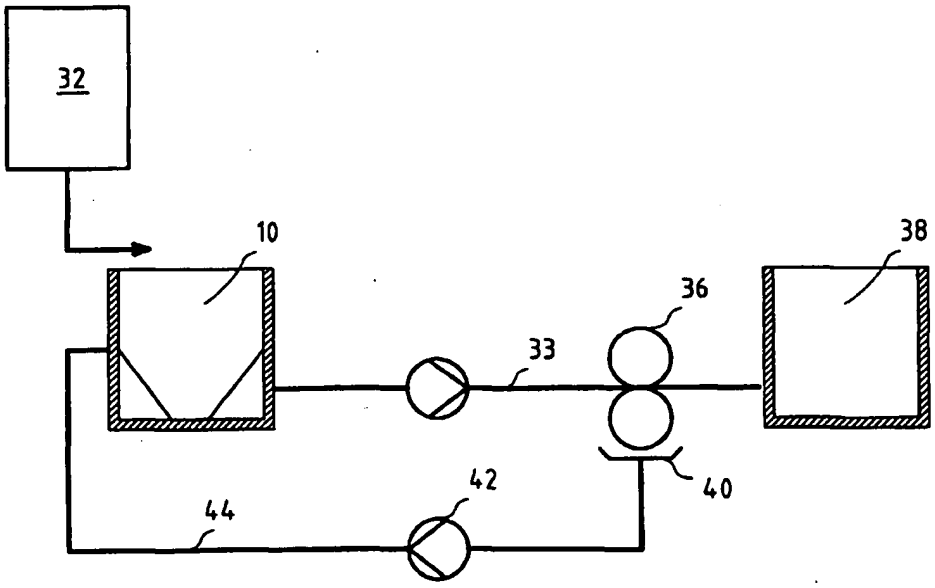

Fig. 2

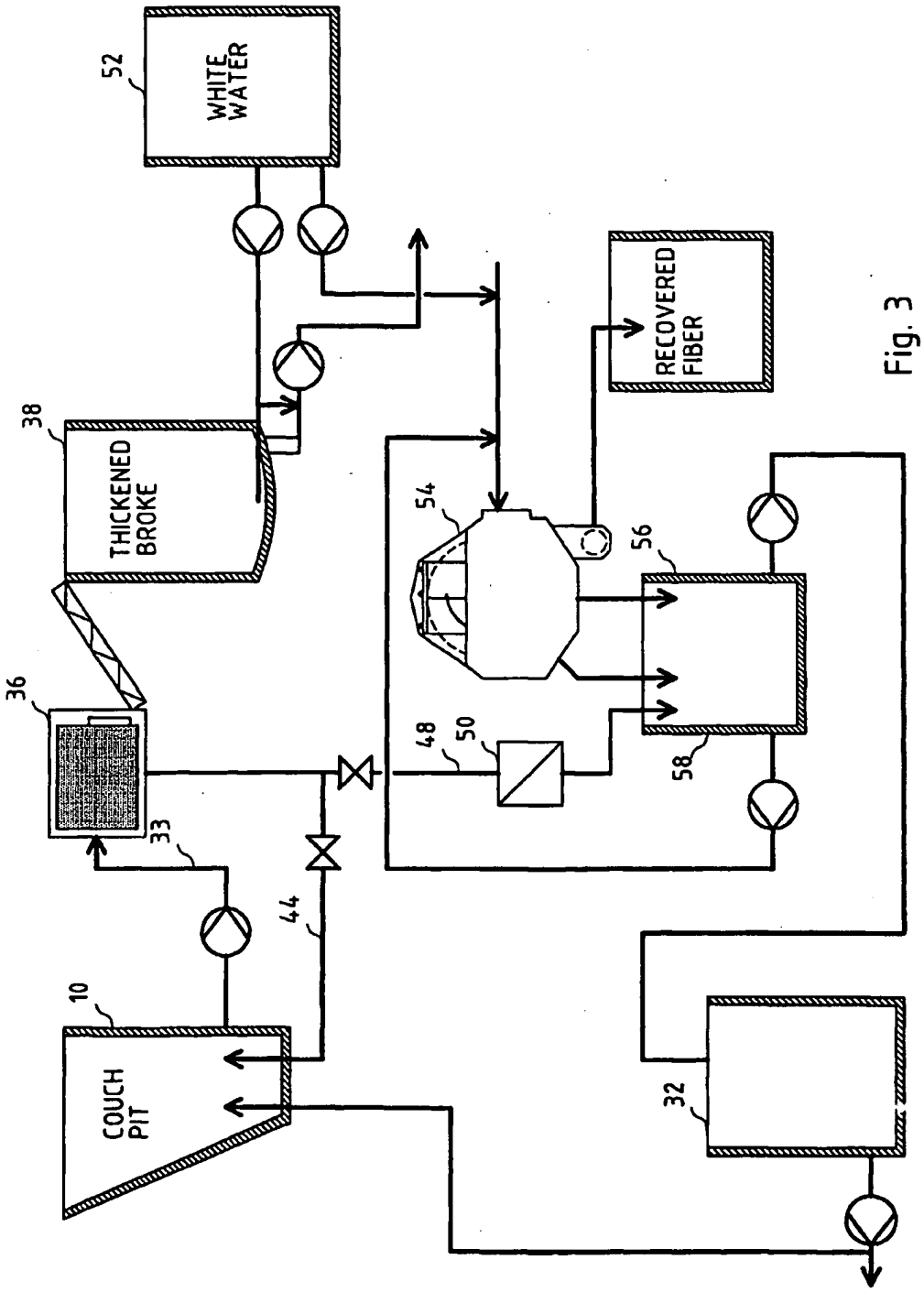
52
WHITE WATER
RECOVERED FIBER
38
THICKENED BROKE
54
56
36
48
50
58
33
44
10
COUCH PIT
32

Fig. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 99 12 3123

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 195 32 301 A (VOITH SULZER STOFFAUFBEREITUNG) 6 March 1997 (1997-03-06) * the whole document *	1,2,4,9, 10,12,13	D21B1/32 D21F1/66

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

D21F
D21B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	18 April 2000	De Rijck, F

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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18-04-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19532301 A	06-03-1997	EP 0761870 A	12-03-1997

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